incident beam to be parallel to the plane of the cantilever can also be accomplished by tilting the lenses, as in view camera photography. Referring to FIG. **8**, a lower lens assembly **94** is secured in a central opening **96** in a threadable lens holder **98** which is secured by bolts **100** and **102** acting in respective bolt holes **104** and **106**. The bolts are threaded through threaded openings **108** and **110** on opposite sides of a central opening **112** in the module **114**. A third bolt (not shown) is out of the drawing sheet but is similarly disposed in a corresponding threaded opening through the module **114** and lens holder **98**. The opening **96** in the lens holder **98** is threaded so that the lens **94** can be moved upwardly and downwardly therein when making course adjustment. By inwardly or outwardly threading one or more of the bolts **100**, the lens **94** can be tilted with respect to the cantilever **14**.

Also shown in FIG. **8** is still another method for securing the cantilever chip **12**. In this case, a lower plate **116** is secured to the lower surface of the module **114** and clamps the cantilever chip **12** between its planed surface **118** and the corresponding oblique surface of the module **120** by means of bolts **122** and **124** through holes **126** and **128** in the module and corresponding holes **130** and **132** in the plate **116**. A spring **134** located in another hole **136** in the module is loaded by means of a bolt head **138** threaded in the top of the module and bearing against the spring **134**, to facilitate release.

A general layout of another embodiment is shown in FIG. **9**. The microscope is compact, formed from an aluminum block housing **140** carried on a base plate **142** which has a central opening **144**. The housing **140** defines a cavity **146** in which is disposed a cantilever module **148**. The module **148** is formed with a medial opening **150** in which a lower lens **152** and upper lens assembly **154** are fixed above a cantilever **156** carried on a cantilever chip **158** which is secured to the bottom of the module **148**. The housing **140** supports a movable lens **160** carried by a lens holder **162** which is movable against a spring **164** by a bolt **166** threadably carried in a bolthole **168** in the block **140** and turned against the bias of the spring **164** by a focus knob **170**. A polarizing beam splitter **172**, above and integral with a quarterwave plate **174** is supported in the path of the light, between the movable lens **160** and the upper lens assembly **154**. The beamsplitter **176** is supported on a tiltstage **182** which includes two adjustment screws **184** and **186** and a pivot point (not shown).

Light from an optical fiber **188** goes through a collimator **190** to be directed by the incident light beamsplitter **176** through openings **192** and **194**, respectively, in the tiltstage **182** and block **140**. The forward end of the collimator **190** abuts a slit **191** into which can be placed a plate having an aperture opening shaped as desired. The tiltstage **182** positions the focused spot on the cantilever **156**. Collimated light from the incident beam splitter **176** travels through the movable lens **160**, polarizing beam splitter **172**, quarterwave plate **174** and fixed lenses **154** and **152** to impinge on the top side of the cantilever **156**.

Light reflected from the cantilever travels back through the fixed lenses **152** and **154**, through the quarterwave plate **174** and is reflected by the beamsplitter **172**.

A detector **196** is positioned in the block cavity **146** and is carried by an arm **198** connected to a detector tiltstage **200** which, by means of adjustment screws two of which, **202** and **204**, are shown, centers the reflected beam onto the detector **196**.

The cantilever module **148** is carried on the base plate **142** by a steel ball **206** on one side and by a steel hemisphere **208** on the other side, and which are located by cavities, respectively **210** and **212** formed in the bottom of the cantilever module **148**. The steel hemisphere **208** is glued to a z-directional tapping piezoelectric actuator **214** which has wires (not shown) leading to a control (not shown) to enable a tapping mode to the cantilever operation. Such placement of the tapping piezoelectric actuator **214** simplifies construction of the device and can replace the piezoelectric tapping actuator located, for example, in the fluid cell. Alternatively, a piezoelectric actuator can be located under each ball supporting the cantilever module.

The sample **216** is supported on a piezoelectric scan tube **218** carried in a scanner assembly **220**. The scan tube **218** is of conventional design well-known in the art whereby application of x-, y-, and z-directional voltages over wires (not shown) moves the sample horizontally and vertically. The base plate **142** is supported on the scanner assembly **220** by means of locating cavities **222** and **224** which interface with steel balls, respectively, **226** and **228** carried on adjustment screws, respectively, **230** and **232**.

We claim:

1. In an atomic force microscope including at least one cantilever mounted therein and an optical detector, the improvement, for generating a small incident beam spot, comprising:

an optical system including a light source and means for producing an incident beam, and at least one lens for focusing said incident beam; and

means for directing said focused incident beam onto said cantilever to reflect therefrom to said detector;

said optical system having a numerical aperture sufficient with the wavelength of light from said light source whereby said focused beam forms a spot on said cantilever having a size of 8 μm or less in at least one dimension.

2. The atomic force microscope of claim **1** in which the components of said optical system are arranged so that at least portions of said incident and reflected beams overlap, and including means for separating said reflected beam from said incident beam and directing said separated reflected beam to said detector.

3. The atomic force microscope of claim **2** in which said separating means comprises a polarizing beamsplitter in the path of said incident and reflected beams arranged to pass light having a first polarization direction and to reflect light having a second polarization direction, and including means located between said beamsplitter and said cantilever, in the path of said overlapping beams, for converting at least a portion of said reflected light beam into said second polarization direction.

4. The atomic force microscope of claim **3** in which said converting means comprises a quarterwave plate that elliptically polarizes the incident beam and linearly polarizes the reflected beam.

5. The atomic force microscope of claim **2** including a polarizer in the path of said incident beam but outside the path of said overlapping beams arranged to pass light having substantially only a first polarization direction, said separating means comprising a beamsplitter in the path of said incident and reflected beams arranged to pass light having said first polarization direction and to reflect light having a second polarization direction and means located between said beamsplitter and said cantilever, in the path of said overlapping beams, for converting at least a portion of said reflected light beam into said second polarization direction.

6. The atomic force microscope of claim **5** in which said converting means comprises a quarterwave plate that ellip-